© 2018 IJSRST | Volume 4 | Issue 5 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Design & Simulation of a 100W Pure Sine Wave Inverter Using IC CD4047

Nilam Rathod, Anjali Sharma, Uvaish Mansur, Prof. MiteshKumar Priyadarshi
Government Engineering College, Modasa, Sabarkantha, Gujarat, India

ABSTRACT

Pure sine wave inverters are demand of modern era whenever it comes to utilization of DC power sources for both law and high power applications. These inverter not only increase the efficiency of the power system but also prevent the electrical components from damaging. These paper à producing cost – effective and efficient pure sine wave inverter in recent times and this paper proposes a design that is highly useful for law power based application.

Keywords: IC CD4047, PWM INVERTER

I. INTRODUCTION

Pure Sine wave inverter is one of the most recognizable technologies that has been utilized by both industrial and private sectors in distributed power generation system. Pure Sine wave inverter one for fairly efficient, inexpensive inverter with a pure sine wave output. Utilizing PWM and analog components the output will be a clean sinusoidal with very little switching noise, combined with the of inexpensive manufacturing that comes with an analog approach. Most of the inverters available in the market have complicated circuit design and are not very economical. Some of them produce square-wave output, which is undesirable for inductive loads. These Project is a simple sine wave inverter circuit that produces 50Hz quasi sine wave output using a single IC CD4047 and some discrete components, which makes it a very cost- effective solution.

Various realization techniques of pure sine wave inverters have been presented and with the ever advancing technology are improving on daily basis. Most of the inverters which are available commercially and incorporated in UPS (Uniterruptible power supply) are mostly square wave inverter or quasi square wave inverter which are not suitable for sophisticated electrical devices and equipment in daily use to their output waveform which constitute of undesirable harmonics.

BLOCK DIAGRAM OF AN SINE WAVE INVERTER

The regulated square wave is not beneficial for the appliances as it may harm them therefore for the appliances to work properly and the energy be used efficiently, pure sine wave inverters are used to produce a pure sine wave at the output for the load.

Fig.1 show the block diagram of sine wave inverters of MOSFET and multivibrator based 50Hz inverter.

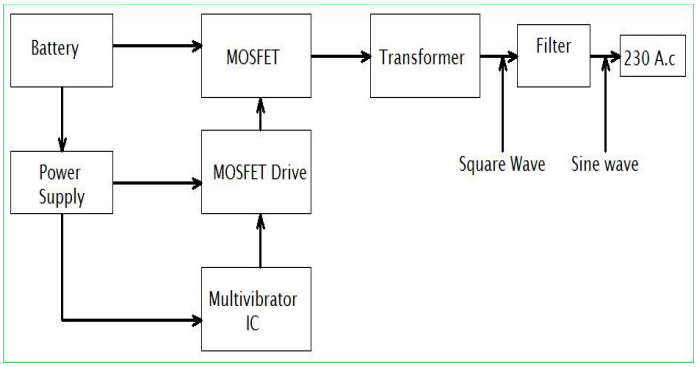

Figure 1. Block Diagram of an Sine wave Inverter

Now Figure 2 Shows the Power Circuit diagram of Pure Sine Wave inverter.

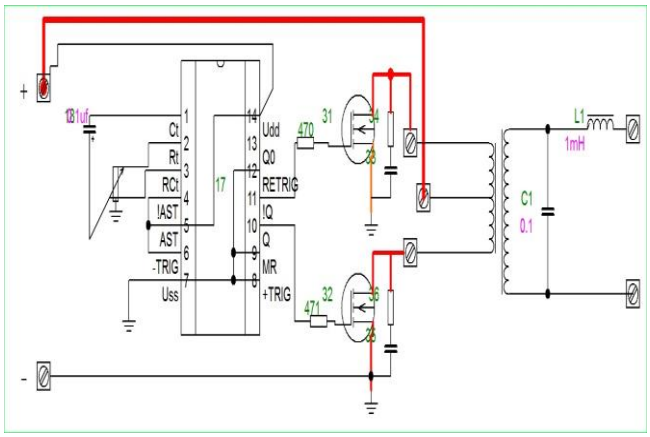

Figure 2. Circuit Diagram of Pure Sine Wave Inverter

It comprise a IC CD4047 and a few discrete components.

In Figure 1 First Battery connected to MOSFET. There are 2 MOSFET used in the fig 1. Then Battery connected to MOSFET and then with power supply. After connection with power supply. Power supply connected with MOSFET drive and IC4047. Here MOSFET work as a inverter and MOSFET drive control the supply. And IC CD4047 is used for pulsing by using MOSFET it is gives the AC voltage but this voltage is not pure AC Voltage. So for Pure AC Voltage connect MOSFET with transformer then Transformer step up or step down the voltage. So the output of this is square wave then transformer connected with LC filter for pure sine wave inverter. By connecting LC filter with transformer, LC filter Convert square wave to pure sine wave.

Pure sine wave inverter may have series of modules to design and they must be able to operate along with competitive efficiency, cost ease of implementations & use.

Component Description

(A) IC CD4047

The main objective of this paper is to produce sinusoidal waveform using multi-vibrator ICs. Therefore the application has been realized using IC CD4047. Which is built in facilities for both astable and bistable multivibrators.

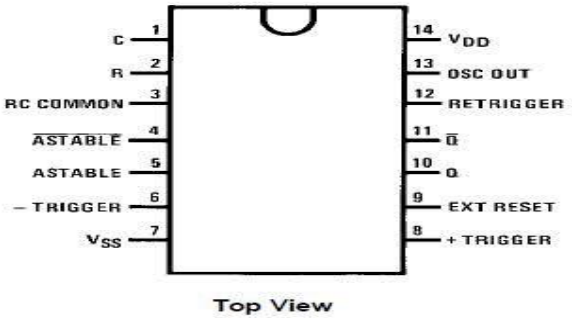

Figure 3. IC CD4047 Pin Diagram)

The inverter application requires two output that are 180 degrees out of phase. There IC is wired to produce square wave output signals at pin 10 and 11 with 50Hz frequency, 50% duty cycle and 180 degree phase shift.

(B) TRANSFORMER

Then main objective of this paper is to step up the voltage and also for parallel operation surge protection etc.

The system has a basic equation of behavior and the stimulus is a pulse step, sine wave or other variable with time. 240v rating of transformer is 230v. Where primary side 12-0-12v and secondary side 70-0-70v.

The voltage and turns ratio calculated with the formula.

$$\frac{V1}{V2} = \frac{N1}{N2}$$

Here, $\frac{V1}{V2} = \frac{240}{12} = 20 = K$

$$\frac{N1}{N2} = \frac{V1}{V2} = 20$$

$N1 = 20*N2 = 70*20 = 1400$

$\frac{N1}{N2}$=20:1

So, this 20:1 ratio required for 240v output.

(C) FILTER

In design of sine wave inverter, there are harmonics produced in output waveform caused by semiconductor switching. For harmonics reduction a LC filter is used.

The value of capacitors are 0.22 micro farads. For parallel capacitor in this circuit it is used for vary and change the value of frequency.

(D) MOSFET

The another objective of this paper is MOSFET. We used 2 MOSFET which name is IRFZ44. The capacity of this two MOSFET is 44A. And this 2 MOSFET work till 538W power.

II. DESIGN OF AN SINE WAVE INVERTER

Specification:-

100W Center tap transformer
Frequncy - 50Hz Output -245V

(1)DC SIDE SIDE CURRENT AND VOLTAGE

DC SIDE

12V Fix voltage
So, current $\frac{100}{12}$ = **8.33A**

BATTERY SELECTION:-

100W For 10 Hours
Amp. 9A For 10 Hours
Capacity = 9*10 = 90 Ah.

AC SIDE

Current Capacity Calculation
P = VIcos ϕ
I = $\frac{p}{245*0.85}$ **= 0.48A**

(2) TRANSFORMER SELECTION:-

100W Rating
Primary = 245V
Secondary = 12-0-12V
Ferrite Core – High Above 20KHz
Iron Core – Low Freq. 100Hz

(3) MOSFET

Voltage for MOSFET = 25.2V
Current for MOSFET = 20.26A
Pulse =180 Degree

(4) IC CD4047

Voltage = 5V
Current = 20Ma
Frequency = 50-100Hz

(5) CURRENT LIMITING RESISTER

100 – 1000 Ω
50 – Hz (variable Resistor)

(6) BATTERY HIGH AND LOW VOLTAGE

Full battery Voltage = 13.5V
Low battery Voltage = 10.5V

(7) CALCULATION OF LC FILTER

LC = $\frac{1}{2\pi\sqrt{fc}}$

fc = $\frac{1}{2\pi\sqrt{lc}}$

$\sqrt{lc} = \frac{1}{2\pi fc}$

$\frac{1}{2*3.14*50}$

$\sqrt{lc} = 3.18*10^{-3}$

$LC = 10.11*10^{-6}$

$LC = 10.11*10^{-6}$

$C = \frac{10.11*10^{-6}}{L}$

$\sqrt{\frac{10.11*10^{-6}}{C}} = \frac{1}{2\pi FC}$

$\sqrt{L} = \frac{3.18*10^{-6}}{L}$

$= \frac{1}{2*3.14*\sqrt{C}}$

$\frac{1}{\sqrt{L}} = \frac{1}{9.98*10^{-4}}$

$\sqrt{L} = 9.98*10^{-4}$

$L = 9.98*10^{-4}$

$L = 0.1*10^{-6}$

L = 0.1mH

III. PROPOSED SYSTEM REALIZATION

The proposed system has two main parts. One power processing side and other one is control side. Power processing side contains the MOSFET which the control side contains the CD4047 IC and gate driver.

IV. SIMULATION OF SINGLE PHASE PURE SINEWAVE INVERTER

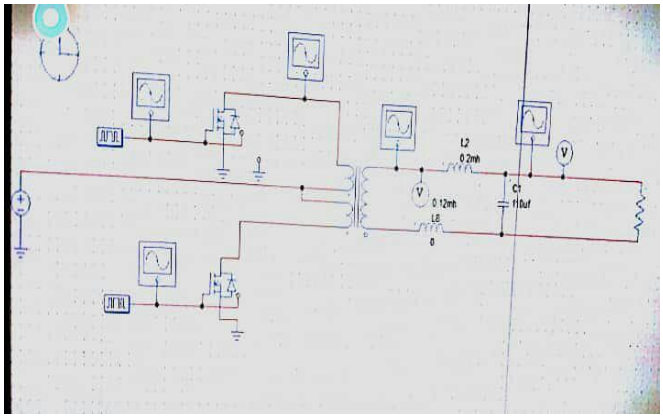

Figure 4. circuit diagram of sine wave inverter

Now, Figure 5 shows the wave of sine wave inverter.

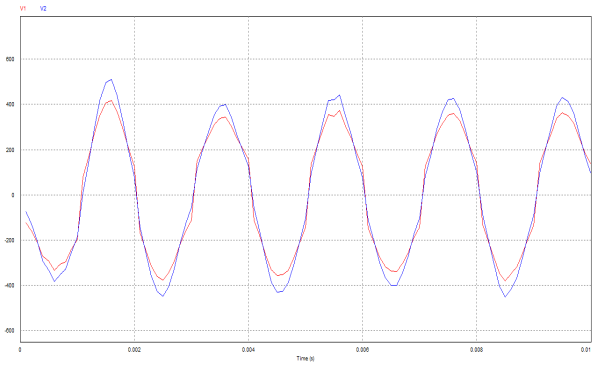

Figure 5. Waveform of Sine wave inverter

V. CONCLISION

This paper is discussed available techniques and tried to come up with a solution for law power application which is carry to implement, cost efficient & compact size or reliable for consumers prospective. We have tried to come up with a design for as well as high power application.

VI. ACKNOWLEDGEMENT

On completion of this research, we would like to acknowledgement afforts of our research faculty, member, Prof. Mitesh Priyadarshi with appreciation whose technical support in field of inverters are very valuable in conducting research & practical implementation of inverter.

VII. REFERENCES

[1]. Krismadinata Chaniago, J. Selvaraj, N. A. Rahim, "Implementation of Single-Phase Grid Connected Inverter Using TMS320F2812," 3rd IEEE Conference on Industrial Electronics and Application, 2008, pp.1498-1502.

[2]. J. U. Duncombe, "Infrared navigation—Part I: An assessment of feasibility," IEEE Trans. Electron Devices, vol. ED-11, pp. 34-39, Jan. 1959.

[3]. C. Y. Lin, M. Wu, J. A. Bloom, I. J. Cox, and M. Miller, "Rotation, scale, and translation resilient public watermarking for images," IEEE Trans. Image Process., vol. 10, no. 5, pp. 767-782, May 2001.